

Claims

- [c1] A method of cleaning a surface comprising the steps of heating a cleaning solution with an exothermic chemical reaction, applying the heated cleaning solution to the surface to clean the surface and recovering soiled cleaning solution from the surface.
- [c2] A method of cleaning a surface according to claim 1 and further comprising the step of activating a chemical compound or combination of chemical compounds to undergo an exothermic chemical reaction.
- [c3] A method of cleaning a surface according to claim 2 wherein the exothermic chemical reaction comprises a phase change in a compound or composition that generates heat when transforming from one phase to another.
- [c4] A method of cleaning a surface according to claim 3 wherein the phase change is from a liquid to a solid.
- [c5] A method of cleaning a surface according to claim 4 wherein the compound or composition is a sodium acetate solution.
- [c6] A method of cleaning a surface according to claim 5 wherein the activation step includes introducing an aluminum metal or alloy into the sodium acetate solution.
- [c7] A method of cleaning a surface according to claim 4 wherein the activation step includes introducing a metal into the liquid.
- [c8] A method of cleaning a surface according to claim 3 wherein the phase change is from one solid phase to another.
- [c9] A method of cleaning a surface according to claim 2 wherein the exothermic chemical reaction comprises the step of combining two or more reagents that, when combined, undergo an exothermic reaction.
- [c10] A method of cleaning a surface according to claim 9 wherein the two or more reagents include a base and an acid that undergo an exothermic reaction when combined.

- [c11] A method of cleaning a surface according to claim 10 wherein the acid is a mild acid that is added to the cleaning solution prior to the combining step and that lowers the pH of the cleaning solution to less than 7.
- [c12] A method of cleaning a surface according to claim 11 wherein the mild acid is a stearic acid.
- [c13] A method of cleaning a surface according to claim 12 wherein the stearic acid reduces the pH of the cleaning solution in the solution tank to the range of 4–5 prior to the combining step.
- [c14] A method of cleaning a surface according to claim 13 wherein the base is triethanolamine.
- [c15] A method of cleaning a surface according to claim 14 wherein the triethanolamine is in a solution that has a pH in the range of 8–9.
- [c16] A method of cleaning a surface according to claim 12 wherein the base is triethanolamine.
- [c17] A method of cleaning a surface according to claim 11 wherein the mild acid reduces the pH of the cleaning solution in the solution tank to the range of 4–5 prior to the combining step.
- [c18] A method of cleaning a surface according to claim 17 wherein the base is in a solution that has a pH in the range of 8–9 and is added to the cleaning solution that includes the mild acid to initiate the exothermic reaction.
- [c19] A method of cleaning a surface according to claim 18 wherein the reaction product of the weak acid and the weak base is a surfactant that becomes part of the cleaning solution.
- [c20] A method of cleaning a surface according to claim 10 wherein the reaction product of the acid and the base is a surfactant that becomes part of the cleaning solution.
- [c21] A method of cleaning a surface according to claim 10 wherein the acid is selected from the group consisting of stearic acid, citric acid and phosphoric

acids.

- [c22] A method of cleaning a surface according to claim 21 wherein the base is selected from the group consisting of diethanolamine, triethanolamine, sodium hydroxide and potassium hydroxide.
- [c23] A method of cleaning a surface according to claim 10 wherein the base is selected from the group consisting of diethanolamine, triethanolamine, sodium hydroxide and potassium hydroxide.
- [c24] A method of cleaning a surface according to claim 9 wherein the heat of the exothermic reaction is transferred indirectly to the cleaning solution.
- [c25] A method of cleaning a surface according to claim 9 wherein the heat of the exothermic reaction is transferred directly to the cleaning solution.
- [c26] A method of cleaning a surface according to claim 9 wherein the two or more reagents are aluminum and a reactant caustic compound.
- [c27] A method of cleaning a surface according to claim 9 wherein the two or more reagents include a supercorroding metal alloy.
- [c28] A method of cleaning a surface according to claim 1 wherein the heat of the exothermic reaction is transferred indirectly to the cleaning solution.
- [c29] A method of cleaning a surface according to claim 1 wherein the heat of the exothermic reaction is transferred directly to the cleaning solution.
- [c30] An extraction cleaner comprising:
a housing;
a cleaning solution dispensing system mounted to the housing and comprising a cleaning solution tank for storing a quantity of cleaning solution, a fluid delivery nozzle and a fluid conduit between the cleaning solution tank and the fluid delivery nozzle to dispense cleaning fluid to a surface to be cleaned,
a fluid recovery system mounted to the housing for recovering soiled cleaning fluid from the surface to be cleaned; and
a heater associated with the cleaning solution dispensing system to heat the

cleaning solution applied to the floor to a temperature above room temperature;
the improvement comprising:
the heater comprises a system for generating an exothermal chemical reaction.

- [c31] An extraction cleaner according to claim 30 and further comprising an activator for selectively initiating the exothermal chemical reaction.
- [c32] An extraction cleaner according to claim 31 wherein the heater comprises a cavity in the cleaning solution tank in heat exchange relationship with cleaning fluid in the cleaning solution tank.
- [c33] An extraction cleaner according to claim 31 wherein the heater further comprises a heat exchanger in heat exchange relationship with cleaning fluid in the fluid conduit between the cleaning solution tank and the fluid delivery nozzle.
- [c34] An extraction cleaner according to claim 32 wherein the exothermal chemical reaction system comprises a compound or composition that generates heat when transforming from one phase to another.
- [c35] An extraction cleaner according to claim 34 wherein the phase change is from a liquid to a solid.
- [c36] An extraction cleaner according to claim 35 wherein the compound or composition is a sodium acetate solution.
- [c37] An extraction cleaner according to claim 36 wherein the activator includes aluminum or an alloy thereof that can be introduced into the sodium acetate solution.
- [c38] An extraction cleaner according to claim 35 wherein the activator includes a metal that can be introduced into the liquid.
- [c39] An extraction cleaner according to claim 34 wherein the phase change is from one solid phase to another.
- [c40] An extraction cleaner according to claim 32 wherein the exothermic chemical reaction system comprises two or more reagents that, when combined, undergo

an exothermic reaction.

- [c41] An extraction cleaner according to claim 40 wherein the two or more reagents include a base and an acid that undergo an exothermic reaction when combined.
- [c42] An extraction cleaner according to claim 30 wherein the exothermic chemical reaction system comprises a mild acid in the cleaning solution tank and the cleaning solution that has a pH of less than 7.
- [c43] An extraction cleaner according to claim 42 wherein the mild acid is a stearic acid.
- [c44] An extraction cleaner according to claim 43 wherein the pH of the cleaning solution in the cleaning solution tank is in the range of 4–5.
- [c45] An extraction cleaner according to claim 44 wherein the base is triethanolamine and forms an activator for the exothermal chemical reaction when added to the stearic acid-containing cleaning solution.
- [c46] An extraction cleaner according to claim 45 wherein the triethanolamine is in a solution that has a pH in the range of 8–9 prior to adding it to the stearic acid-containing cleaning solution.
- [c47] An extraction cleaner according to claim 46 wherein the base is triethanolamine.
- [c48] An extraction cleaner according to claim 42 wherein the pH of the cleaning solution in the solution tank is the range of 4–5.
- [c49] An extraction cleaner according to claim 48 wherein the base is in a solution that has a pH in the range of 8 to 9 prior to combining it with the acid to initiate the exothermic chemical reaction.
- [c50] An extraction cleaner according to claim 42 wherein the reaction product of the mild acid and the base is a surfactant that becomes part of the cleaning solution.

- [c51] An extraction cleaner according to claim 41 wherein the acid is selected from the group consisting of stearic acid, citric acid and phosphoric acids.
- [c52] An extraction cleaner according to claim 51 wherein the base is selected from the group consisting of diethanolamine, triethanolamine, sodium hydroxide and potassium hydroxide.
- [c53] An extraction cleaner according to claim 41 wherein the base is selected from the group consisting of diethanolamine, triethanolamine, sodium hydroxide and potassium hydroxide.
- [c54] A method of cleaning a surface according to claim 40 wherein the two or more reagents are aluminum and a reactant caustic compound.
- [c55] An extraction cleaner according to claim 40 wherein the two or more reagents include a supercorroding metal alloy.
- [c56] An extraction cleaner according to claim 30 wherein the exothermic chemical reaction system is within the cleaning solution tank whereby the heat of the exothermic reaction is transferred directly to the cleaning solution.
- [c57] An extraction cleaner according to claim 30 wherein the heater comprises a cavity in the cleaning solution tank in heat exchange relationship with cleaning fluid in the cleaning solution tank.
- [c58] An extraction cleaner according to claim 30 wherein the heater further comprises a heat exchanger in heat exchange relationship with cleaning fluid in the fluid conduit between the cleaning solution tank and the fluid delivery nozzle.
- [c59] An extraction cleaner according to claim 30 wherein the exothermal chemical reaction system comprises a compound or composition that generates heat when transforming from one phase to another.
- [c60] An extraction cleaner according to claim 30 wherein the exothermic chemical reaction system comprises two or more reagents that, when combined, undergo an exothermic reaction.

- [c61] An extraction cleaner according to claim 30 and further comprising a heat exchanger including an electrical heater element positioned in the cleaning solution dispensing system for adding heat to the cleaning solution.
- [c62] An extraction cleaner according to claim 61 wherein the heat exchanger is an immersion heater mounted within the cleaning solution tank.
- [c63] An extraction cleaner according to claim 62 wherein the heat exchanger is an in-line heater mounted in the fluid conduit between the cleaning solution tank and the fluid delivery nozzle.